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(19) (CA) **CANADIAN PATENT** (12)

(54) Method for Removing a Depression in a Floor

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No. OF CLAIMS 7

**Canada**

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A B S T R A C T

The method relates to lifting of a depression in a floor, especially in a concrete floor lying on the earth. A hole/holes are made in the floor, and polyurethane foam is injected between the concrete floor and the earth through these holes. The foam creates a pressure between the floor and the earth which lifts the concrete floor at the area of the depression. The lifting process is monitored by measuring instruments.

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This invention relates to a method for removing a depression in a floor.

A depression in a concrete floor, especially one resting upon earth is rather common. Such depressions are caused e.g. by the negligence in the preparatory work to concrete casting, or e.g. by insufficient compacting of, or by ice in, the earth under the concrete, this being especially true in the wintertime. The depressions spoil the quality of the floor and cause technical difficulties in the reinforcing mesh, because the inclination of the floor is altered at various parts.

10. The object of this invention is to provide a method, by which the floor lying upon sunken earth substrate can be lifted or raised back to the desired height.

In the method according to this invention a polyurethane foam is injected between the concrete floor at the depressed region, and the earth and/or the insulating layer, whereby the polyurethane foam when expanding creates a pressure, which lifts the concrete floor at the depressed region. In a more specific form of the invention a closed cell polyurethane cell material is used. It is sprayed or injected under the floor through a bored hole in the floor. When expanding, the polyurethane foam creates a mould pressure up to  $0.4 \text{ MN/m}^2$ . Thus the floor is pushed upwardly at the depression to the desired height. This height that the floor will be raised to is controlled by controlling the quantity of the polyurethane sprayed through the hole. The reaction (expanding) time of polyurethane is about 20-30 seconds from the time of spraying. The hardened

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- 1 -



1210605

- 2 -

1 polyurethane then holds up the floor and simultaneously  
2 serves as an heat insulator.

3  
4 The advantages of the method are at least the  
5 following:

6 - The lifting of the floor can be followed during the  
7 whole raising operation.

8 - The speed of lifting can, in practise, be regulated  
9 to be as slow and even as desired.

10 - The size of the floor area does not affect the  
11 evenness of the lifting process.

12 - The foam also fills the holes made for spraying  
13 purposes. Consequently the loads on the floor are trans-  
14 mitted directly to the soil.

15 - It is not necessary to change the floor cover.

16 - The weight of the concrete floor plate is not  
17 increased, and humidity is not created in the structure.

18 - It is not necessary to remove or free any stationary  
19 piece of furniture due to the lifting operation.

20 - During the lifting operation normal activity can  
21 continue in the building.

22 - The method can be carried out very quickly.

23  
24 The invention is further described below with reference  
25 to the enclosed drawing which schematically illustrates the  
26 method.

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- 3 - 1210605

1 Before the actual lifting the floor to be raised will  
2 be measured at the depressions and on the basis of a level-  
3 ling contour map, a lifting plan will be drawn up. Through  
4 the floor and within the area to be raised, holes 1 are  
5 drilled through the floor 2 and possibly through insulating  
6 plates to the soil 3. The holes are drilled about one meter  
7 apart. The polyurethane foam is then sprayed or injected  
8 through holes 1 with a spraying device 4, the nozzle 5 of  
9 which fits accurately into the hole 1. The spraying device  
10 is connected by a hose 8 to a high pressure moulding machine  
11 (not shown) in which the polyurethane is mixed.

12  
13 Usually under working conditions the foam consists of  
14 two components; the first being a blended polyol mixture of  
15 polyetherpolyol, catalysts and water, e.g. product RM 109  
16 produced by Baxenden Chemicals, Denmark or Resifoam\* AL 369  
17 produced by Resina Chemic, The Netherlands; and the second  
18 being MDI Isocyanate, e.g. Desmador\* produced by Bayer A.G.,  
19 Germany. The physical properties of the foam are  
20 preferably:

21 Density 30-60 Kg/M<sup>3</sup>  
22 Compressibility 2-5 K.P. (Kiloponds)/CM<sup>2</sup>  
23 Void size of cell 0.05-0.5 mm diameter  
24 No. of closed cells Min. 90% (Remington)

25  
26 \* Trade Mark

1210605

- 4 -

1           The expanding of the polyurethane foam 6 injected under  
2           the floor causes lifting of the floor in the direction of  
3           the arrows 7. During the injection the lifting is  
4           continuously verified, with a measure such as a rule and a  
5           level yarn or cord or if higher accuracy is required, with a  
6           levelling device or with some other means. The rate of  
7           lifting can, in practice, be regulated to be as slow and  
8           accurate as desired. The polyurethane foam reaches its  
9           final strength in seconds and when lifting the floor only a  
10          necessary quantity of polyurethane is injected through each  
11          hole as required. Simultaneously the lifting of the floor  
12          is followed up by more injected polyurethane.

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THE EMBODIMENTS OF THE INVENTION IN WHICH AN EXCLUSIVE PROPERTY OR PRIVILEGE IS CLAIMED ARE DEFINED AS FOLLOWS:

1. An improved method for levelling sunken or broken portions of earth-supported floors and slabs, comprising the steps of:  
mixing the components of an expanded polymeric foam; and  
injecting the unexpanded mixture of said components beneath a sunken or broken portion of an earth-supported floor or slab, whereby the expansion of said foam between said portion and the earth creates a mould pressure which raises said portion toward a position level with the remainder of said floor or slab.
2. A method according to Claim 1, wherein said foam is a closed cell polyurethane foam.
3. A method according to Claim 1, wherein said floor or slab is supported by an insulation layer resting on the earth and said mixture is injected between said insulation layer and the earth.
4. A method according to Claim 1, further comprising the steps of:  
drilling at least one hole through said floor or slab at said sunken or broken portion; and  
injecting said mixture through said at least one hole.
5. A method according to Claim 4, wherein a plurality of holes are drilled around said sunken or broken portion.
6. A method according to Claim 1, further comprising the step of measuring the elevation of said sunken or broken portion following said expansion, to monitor the return of said portion to a position level with the remainder of said floor or slab.
7. A method according to Claim 6, wherein said injecting is terminated while said measuring is completed, after which more of said mixture may be injected to further raise said sunken or broken portion.

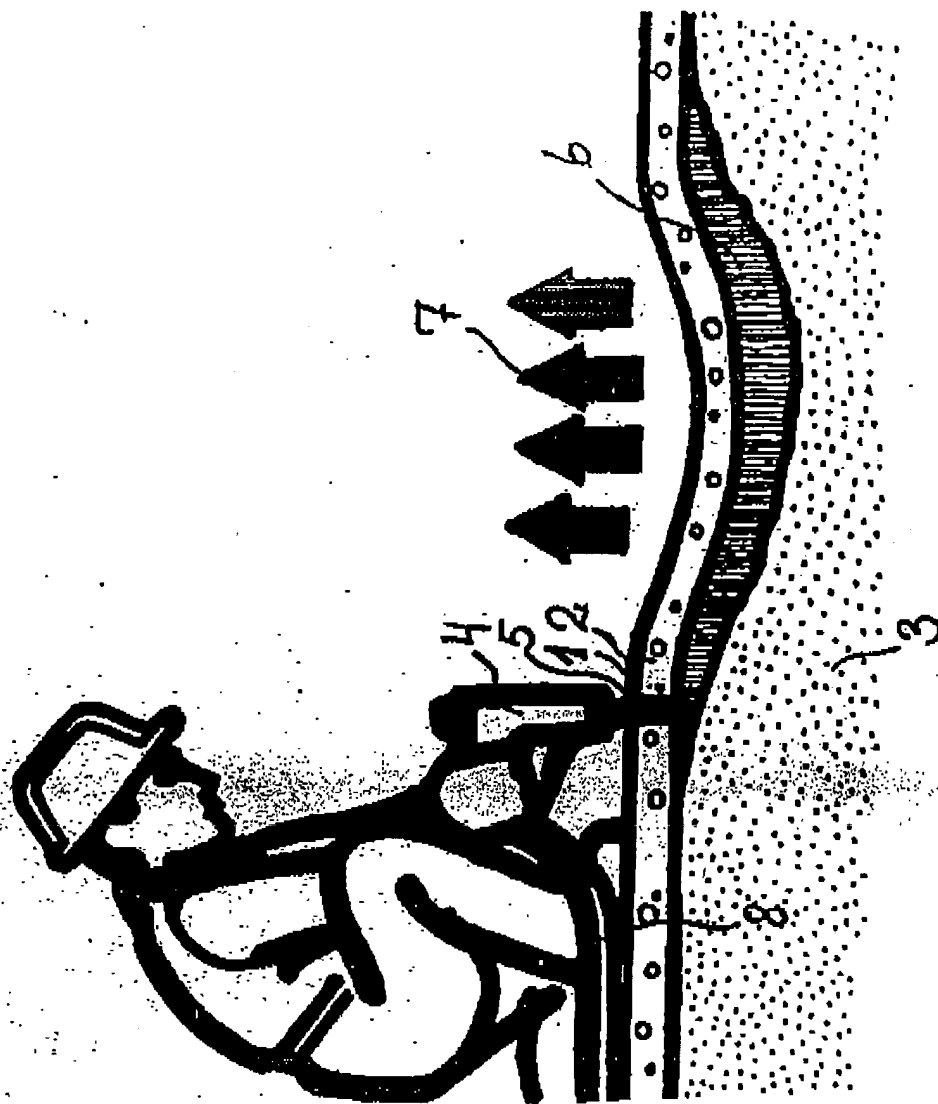
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*Scott & Lydon*